

# Metal Fabrication Technology

Program of Studies  
2014-2015



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Office of Career and Technical Education  
Kentucky Department of Education



# Metal Fabrication Technology

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# Metal Fabrication Technology

## Overview of Metal Fabrication Technology

### Purpose:

The vision of Metal Fabrication Technology is to promote safety standards, performance standards, enhance leadership, provide relevant curriculum, and to be vital to the education of all students.

### Students will:

- Operate as the venue for nationally recognized industry standard training.
- Provide a critical link in school to employment or postsecondary education.
- Develop stronger relationships with the community in terms of mutual advocacy, cooperative field experiences, employment placement, and support for relevant student organizations and competitions
- Represent an important component in the education of all students.
- Require and promote critical thinking and problem solving.
- Offer an up to date curriculum based on standards that adapts to changes in the industry.
- Integrate academic skills into the Computer Aided Design Technology Curriculum in order to insure that students develop written & verbal communications skills, computational skills, and scientific/math problem-solving skills.

### Career Pathways:

- *Precision Sheet Metal Assistant*
- *Sheet Metal Layout Assistant*
- *Sheet Metal Worker*
- *Sheet Metal Production Helper*

### Standard Based Curriculum

The Metal Fabrication Technology curriculum is composed of standards based competencies. All Metal Fabrication Technology programs incorporate industry and common core standards thus increasing the student's qualifications toward successful employment.

Alignment of the Metal Fabrication Technology curriculum with nationally recognized industry standards and the common core standards provides optimal preparation for students to acquire an industry certification.

Communities understand that this preparation provides better career opportunities for students and the demands of today's workforce for the 21<sup>st</sup> century.

### Kentucky Occupational Skill Standards

The Kentucky Occupational Skill Standards are the performance specifications that identify the knowledge, skills, and abilities an individual needs to succeed in the workplace. Identifying the necessary skills is critical to preparing students for entry into employment or postsecondary education. These standards described the necessary **occupational**, **academic**, and **employability** skills needed to enter the workforce or post- secondary education in specific career areas. There

is an ongoing effort to continue to refine these standards by which exemplary Career and Technical Education Programs are evaluated and certified. This helps insure that curriculum meets industry specifications.

### **Work Based Learning**

Cooperative experience, internships, shadowing and mentoring opportunities provide depth and breadth of learning in the instructional program and allow students to apply the concepts learned in the classroom. The Work Base Learning Guide is available on the KDE webpage: [www.education.ky.gov](http://www.education.ky.gov).

### **Student Organizations and Competitions**

Participation in Skills USA Competition provides a vehicle for students to employ higher order thinking skills, to interact with high-level industry people and to further enhance their leadership skill through their participation in regional, state and national competitive events and local activities.

**KDE/OCTE Career Pathways  
Metal Fabrication Technology  
2014-2015**

Career Pathway	Core Courses	Elective Courses
<ul style="list-style-type: none"> <li><i>Precision Sheet Metal Technician</i></li> </ul> <p><b>CIP Code-48.0506.01</b></p> <p><u><i>Tests for Certification</i></u></p> <ul style="list-style-type: none"> <li>National Center for Construction and Education Research (NCCER) Metal Fabrication Level 1</li> <li>Kentucky TRACK Pre-Apprenticeship Certification</li> <li>KOSSA-Manufacturing Test</li> </ul>	<ul style="list-style-type: none"> <li>Metal Trade Information &amp; Metals-480816</li> <li>Parallel Line Layout-480813</li> <li>Radial Line Development-480814</li> <li>Sheet Metal 1-A-480817</li> </ul>	<ul style="list-style-type: none"> <li>Sheet Metal 1-A-480818</li> <li>Sheet Metal II-A-480819</li> <li>Sheet Metal II-B-480820</li> <li>Sheet Metal print Reading-480825</li> <li>Construction Prints-460217</li> <li>CO-OP I (Metal Fab)-480803</li> <li>CO-OP II (Metal Fab) -480804</li> <li>CO-OP III (Metal Fab) -480805</li> <li>Heat Load/Duct Design-480812</li> <li>Internship (Metal Fab)480806</li> <li>Special Projects (Metal Fab)-480879</li> <li>Math for Metal Fabrication-480822</li> <li>PLTW IED-Introduction to Engineering Design-219901</li> </ul>
<ul style="list-style-type: none"> <li><i>Sheet Metal Layout Technician</i></li> </ul> <p><b>CIP Code-48.0506.02</b></p> <p><u><i>Tests for Certification</i></u></p> <ul style="list-style-type: none"> <li>National Center for Construction and Education Research (NCCER) Metal Fabrication Level 1</li> <li>Kentucky TRACK Pre-Apprenticeship Certification</li> <li>KOSSA-Manufacturing Test</li> </ul>	<ul style="list-style-type: none"> <li>Metal Trade Information &amp; Metals-480816</li> <li>Parallel Line Layout-480813</li> <li>Radial Line Development-480814</li> <li>Sheet Metal 1-A-480817</li> </ul>	<ul style="list-style-type: none"> <li>Sheet Metal 1-B-480818</li> <li>Sheet Metal II-A-480819</li> <li>Sheet Metal II-B-480820</li> <li>Sheet Metal print Reading-480825</li> <li>Construction Prints-460217</li> <li>CO-OP I (Metal Fab)-480803</li> <li>CO-OP II (Metal Fab) -480804</li> <li>CO-OP III (Metal Fab) -480805</li> <li>Heat Load/Duct Design-480812</li> <li>Internship (Metal Fab)480806</li> <li>Special Projects (Metal Fab)-480879</li> <li>Math for Metal Fabrication-480822</li> <li>PLTW IED-Introduction to Engineering Design-219901</li> </ul>

<p><b><u>Sheet Metal Worker</u></b></p> <p>CIP Code-48.0506.03</p> <p><b><u>Tests for Certification</u></b></p> <ul style="list-style-type: none"> <li>National Center for Construction and Education Research (NCCER) Metal Fabrication Level 1</li> <li>Kentucky TRACK Pre-Apprenticeship Certification</li> <li>KOSSA-Manufacturing Test</li> </ul>	<ul style="list-style-type: none"> <li>Metal Trade Information &amp; Metals-480816</li> <li>Parallel Line Layout-480813</li> <li>Radial Line Development-480814</li> <li>Sheet Metal 1-A-480817</li> </ul>	<ul style="list-style-type: none"> <li>CO-OP I (Metal Fab)-480803</li> <li>CO-OP II (Metal Fab) -480804</li> <li>CO-OP III (Metal Fab) -480805</li> <li>Heat Load/Duct Design-480812</li> <li>Internship (Metal Fab)480806</li> <li>Special Projects (Metal Fab)-480879</li> <li>Sheet Metal 1-A-480818</li> <li>Sheet Metal II-A-480819</li> <li>Sheet Metal II-B-480820</li> <li>PLTW IED-Introduction to Engineering Design-219901</li> </ul>
<ul style="list-style-type: none"> <li><b><u>Sheet Metal Production Technician</u></b></li> </ul> <p>CIP Code-48.0506.04</p> <p><b><u>Tests for Certification</u></b></p> <ul style="list-style-type: none"> <li>National Center for Construction and Education Research (NCCER) Metal Fabrication Level 1</li> <li>Kentucky TRACK Pre-Apprenticeship Certification</li> <li>KOSSA-Manufacturing Test</li> </ul>	<ul style="list-style-type: none"> <li>Metal Trade Information &amp; Metals-480816</li> <li>Parallel Line Layout-480813</li> <li>Sheet Metal 1-A-480817</li> <li>Sheet Metal 1-A-480818</li> </ul>	<ul style="list-style-type: none"> <li>CO-OP I (Metal Fab)-480803</li> <li>CO-OP II (Metal Fab) -480804</li> <li>CO-OP III (Metal Fab) -480805</li> <li>Heat Load/Duct Design-480812</li> <li>Internship (Metal Fab)480806</li> <li>Special Projects (Metal Fab)-480879</li> <li>Sheet Metal II-A-480819</li> <li>Sheet Metal II-B-480820</li> <li>Sheet Metal print Reading-480825</li> <li>Radial Line Development-480814</li> <li>Construction Prints-460217</li> <li>Math for Metal Fabrication-480822</li> <li>PLTW IED-Introduction to Engineering Design-219901</li> </ul>

<ul style="list-style-type: none"> <li><b><u>Metal Fabrication-TRACK</u></b></li> </ul> <p>CIP Code-48.0506.04</p> <p><b><u>Tests for Certification</u></b></p> <ul style="list-style-type: none"> <li>National Center for Construction and Education Research (NCCER) Metal Fabrication Level 1</li> <li>Kentucky TRACK Pre-Apprenticeship Certification</li> <li>KOSSA-Manufacturing Test</li> </ul>	<ul style="list-style-type: none"> <li>(4)- Core courses</li> <li>Chosen from IMT valid course list.</li> <li>By Company sponsoring State Registered Apprenticeship.</li> </ul>	<ul style="list-style-type: none"> <li>(4)- Core courses</li> <li>Chosen from IMT valid course list.</li> <li>By Company sponsoring State Registered Apprenticeship.</li> </ul>
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Kentucky Career Pathway/Program of Study Template									
College/University		Kentucky College/University/KCTCS				Cluster:		Manufacturing	
High School (S):		Boone County ATC School				Pathway:		Manufacturing Management	
						Program:		Metal Fabrication	
Grade	English	Math	Science	Social Studies	Required Courses Recommended Elective Courses Other Elective Courses			Credential Certificate Diploma Degree	Sample Occupations
9	English I	Algebra I	Earth Science	Economics	History	Health & PE			
10	English II	*See Construction Geometry	Biology	U.S. History	World Geography	World Geography	World Geography		
11	English III	Algebra II	Physical Science	Metal Trade Info.	Parallel Line	Sheet Metal	Sheet Metal I Lab		
12	English IV	4th Math		Sheet Metal II	Sheet Metal II Lab	Special Proj.	Radial Line	NCCER Certification / TRACK Pre-Apprenticeship	Sheet Metal Layout Worker
		Take ACT - Apply for admission to Northern Kentucky University							
Year 13	Writing	Math	Science	Computer Applications	Materials and Methods of Construction	Intro to Construction	Estimating		
Year 14	Communications	Math	Humanities	Social Interaction	Plane Surveying	Managerial Reports	Soils and Foundations		
Year 15	Communications	Humanities	Psychology	Economics	Construction Contracts	Estimating II	Occupational Safety		
Year 16	Arts and Humanities	Math	Science		Structural Systems	Strength of Materials	Surveying	Bachelor's Degree	Construction Manager
		Required Courses							
		Recommended Elective Courses							
		Other Elective Courses							
Funded by the U. S. Department of Education (V05 B 020001)		Career and Technical Education Courses							
Revised Jan. 2005		Credit-Based Transition Programs (e.g. Dual/Concurrent Enrollment, Articulated Courses, 2+2+2)							
October, 2006-CTE/Kentucky		(♦ =High School to Comm. College) (• =Com. College to 4-Yr Institution) (■ = Opportunity to test out)							
		Mandatory Assessments, Advising, and Additional Preparation							
		Note: Categories of courses (e.g. Required, Recommended Electives, other Electives and career and Technical Education) apply both secondary and postsecondary levels.							

## **Metal Fabrication Technology Courses/Tasks**

### **Blueprint Reading for Construction 460217**

**Course Description:**

This course will provide a series of lectures, demonstrations, and practice exercises in the study of symbols, views, sections, details, and material lists found on architectural working drawings, building materials and specifications lists, and construction dimensioning systems and charts/schedules.

Prerequisites: None

**Content/ Process****Students Will:**

1. Demonstrate view projection techniques as applicable to the construction trades
2. Identify line types used in combinations
3. Identify standards listings on construction working drawings and details
4. Interpret various symbols and uses
5. List procedural construction requirements from notations on working drawings and details
6. Specify duty-specific uses of contour and grade notes
7. Determine overall measurement (lengths, heights, and depths)
8. Describe various materials' usage in sectioned drawings
9. Describe assembly techniques used in various sectioned drawings
10. Complete various sectioned views
11. Define various terms
12. Identify various prefabricated materials from vendor catalogs
13. Display an understanding of financing procedures
14. Construct a materials control chart for a construction project
15. Display an understanding of door and window schedules
16. Determine structural calculations
17. Identify plumbing, air conditioning, electrical, concrete construction, and building procedures and techniques from various related details and drawings
18. Compile a duty-specific hardware list for a construction project
19. List duty-specific fire prevention techniques
20. Identify and list duty-specific problems in a multistory dwelling
21. Identify all construction documents required in the completed building process.

**Connections:**

\*Common Core Standards

\*KOSSA

\*Common Core Technical Standards

\*New Generation Science Standards

\*NCCER Industry certifications

\*Post-Secondary Education

\*CTSO's-Skills USA

**Cooperative Education I**  
**480803**

**Course Description:**

Cooperative Education provides supervised on-the-job work experience related to the student's educational objectives. Students participating in the Cooperative Education program receive compensation for their work.

Prerequisites: Permission of the Instructor

**Content /Process**

**Students Will:**

1. Gain career awareness and the opportunity to test career choice(s)
2. Receive work experience related to career interests prior to graduation
3. Integrate classroom studies with work experience
4. Receive exposure to facilities and equipment unavailable in a classroom setting
5. Increase employability potential after graduation
6. Earn funds to help finance education expenses

**Connections:**

\*Common Core Standards

\*KOSSA

\*Common Core Technical Standards

\*New Generation Science Standards

\*NCCER Industry certifications

\*Post-Secondary Education

\*CTSO's-Skills USA

## **Cooperative Education II**

### **480804**

**Course Description:**

Cooperative Education provides supervised on-the-job work experience related to the student's educational objectives. Students participating in the Cooperative Education program receive compensation for their work.

Prerequisites: Permission of the Instructor

**Content /Process****Students Will:**

1. Gain career awareness and the opportunity to test career choice(s)
2. Receive work experience related to career interests prior to graduation
3. Integrate classroom studies with work experience
4. Receive exposure to facilities and equipment unavailable in a classroom setting
5. Increase employability potential after graduation
6. Earn funds to help finance education expenses

**Connections:**

\*Common Core Standards

\*KOSSA

\*Common Core Technical Standards

\*New Generation Science Standards

\*NCCER Industry certifications

\*Post-Secondary Education

\*CTSO's-Skills USA

**Cooperative Education III**  
**480805**

**Course Description:**

Cooperative Education provides supervised on-the-job work experience related to the student's educational objectives. Students participating in the Cooperative Education program receive compensation for their work.

Prerequisites: Permission of the Instructor

**Content /Process**

**Students Will:**

1. Gain career awareness and the opportunity to test career choice(s)
2. Receive work experience related to career interests prior to graduation
3. Integrate classroom studies with work experience
4. Receive exposure to facilities and equipment unavailable in a classroom setting
5. Increase employability potential after graduation
6. Earn funds to help finance education expenses

**Connections:**

\*Common Core Standards

\*KOSSA

\*Common Core Technical Standards

\*New Generation Science Standards

\*NCCER Industry certifications

\*Post-Secondary Education

\*CTSO's-Skills USA

## Heat Load/Duct Design 480812

**Course Description:**

Introduces the fundamentals needed to calculate heat gain and heat loss, thereby determining air conditioner/furnace size. This information will be used to calculate the correct duct size. Procedures to lay out a duct system as outlined in ACCA MANUAL D are presented.  
Prerequisites: None

**Content /Process****Students Will:**

1. Define "U" value
2. Define "K" value
3. Define "C" value
4. Define "R" value
5. Interpret heat transfer tables ("U", "K", "C", "R")
6. Calculate total heat transfer value of any surface (R) - (U)
7. Explain the heat load sources: conduction, infiltration, product, miscellaneous loads (people, motors, equipment)
8. Explain the purpose of vapor barriers
9. Interpret tables of specific heat values, latent heat, and heat of respiration
10. Identify various points on a psychrometric chart
11. Calculate: refrigeration-sensible heat ratio, contact factor, latent heat, sensible heat, total heat, water removal, mixed air condition
12. Explain: specific humidity, apparatus dew point, contact factor, relative humidity, dry-bulb, wet-bulb, dew point, and enthalpy
13. Plot and chart psychrometric terms
14. Determine total resistance to heat flow ("R"), ("U")
15. Interpret structure design data
16. Interpret building prints - size of rooms, etc.
17. Calculate conduction loss for: walls, roof, floors, windows, basement (walls, floor), unconditioned space
18. Calculate infiltration: doors, windows
19. Calculate ventilation load
20. Calculate duct loss
21. Calculate "U" values for building materials
22. Calculate CLTD (Cooling Load Temperature Difference)
23. Make corrections for CLTD
24. Calculate conduction loads for: walls, roofs, windows, doors, non-conditioned space, floors
25. Calculate lighting load
26. Determine size of equipment needed
27. Calculate infiltration and ventilation
28. Calculate duct gain
29. Calculate refrigeration-sensible heat ratio

30. Practice/observe safety procedures/techniques
31. Draw layout of return and supply runs
32. Calculate equivalent length of trunk and branch ducts
33. Calculate total effective length of duct runs
34. Calculate total available static pressure
35. Size trunk and branch ducts by equal friction method
36. Use duct calculator to find duct size, velocity, CFM, and friction loss
37. Calculate air flow factors for heating and cooling
38. Size registers, grills, and diffusers
39. Identify types of mechanical filters: disposable, permanent foam, mesh, fiber, and high efficiency
40. Describe operation of electronic air cleaners
41. Install air cleaner system into existing ductwork

### **Connections:**

\*Common Core Standards

\*KOSSA

\*Common Core Technical Standards

\*New Generation Science Standards

\*NCCER Industry certifications

\*Post-Secondary Education

\*CTSO's-Skills USA

**Internship (Metal Fab)**  
**480806**

**Course Description:**

Internship provides supervised on-the-job work experience related to the student's educational objectives. Students participating in the Internship do not receive compensation.

Prerequisites: Permission of the Instructor

**Content /Process**

**Students Will:**

1. Gain career awareness and the opportunity to test career choice(s)
2. Receive work experience related to career interests prior to graduation
3. Integrate classroom studies with work experience
4. Receive exposure to facilities and equipment unavailable in a classroom setting
5. Increase employability potential after graduation

**Connections:**

\*Common Core Standards

\*KOSSA

\*Common Core Technical Standards

\*New Generation Science Standards

\*NCCER Industry certifications

\*Post-Secondary Education

\*CTSO's-Skills USA

**Metal Trade Information and Metals  
480816**

**Course Description:**

A series of lectures and demonstrations of hand tools, use of machinery in the shop, and various types of metal and their uses in the metal trade will be discussed.

Prerequisites: None

**Content /Process**

**Students Will:**

1. Apply work site and lab safety procedures
2. Apply personal safety rules and procedures
3. Apply fire prevention rules and procedures
4. Demonstrate hazardous communication procedures
5. Describe and demonstrate universal precaution procedures
6. Identify common sheet metal fabrication hand tools
7. Demonstrate proper use of common sheet metal fabrication hand tools
8. Obtain First Aid certification
9. Obtain CPR Certification
10. Use and care for tools and equipment
11. Select appropriate sheet metal gauges
12. Select specified types of sheet metals

**Connections:**

\*Common Core Standards  
\*KOSSA  
\*Common Core Technical Standards  
\*New Generation Science Standards  
\*NCCER Industry certifications  
\*Post-Secondary Education  
\*CTSO's-Skills USA

**Math for Metal Fabrication**  
**480822**

**Course Description:**

This course is a review of basic math.

Prerequisites: None

**Content /Process**

**Students Will:**

1. Measure sheet metal to determine the available space for assembly pattern
2. Use the radial line method to layout sheet metal patterns
3. Use the triangular method to layout sheet metal patterns
4. Use the parallel line method to layout sheet metal patterns

**Connections:**

\*Common Core Standards

\*KOSSA

\*Common Core Technical Standards

\*New Generation Science Standards

\*NCCER Industry certifications

\*Post-Secondary Education

\*CTSO's-Skills USA

## **Parallel Line Layout 480813**

### **Course Description:**

This course introduces the parallel line method of developing the pattern for an object. In addition, this course presents basic applied math, lines, multi-view drawings, symbols, various schematics and diagrams, dimensioning techniques, sectional views, auxiliary views, and sketching typical to sheet metal drawings. Safety will be emphasized as an integral part of the course.

Prerequisites: Metal Trade Information and Metals-480816

### **Content /Process**

#### **Students Will:**

1. Identify the purposes for parallel line layout
2. Identify parts fabricated with parallel line layout methods
3. Use the parallel line method to lay out sheet metal patterns
4. Identify hand tools required for parallel line layout development
5. Measure sheet metal to determine the available space for assembly pattern
6. Select appropriate sheet metal gauge
7. Form sheet metal assemblies with bench stakes and mallets
8. Introduction and math review (fractions and decimals)
9. Identify line types used in combinations
10. Identify multiple views
11. Arrange multiple views
12. Demonstrate visualizing techniques of multiple views
13. Identify one view drawing
14. Arrange and identify auxiliary views
15. Demonstrate the use of size and location dimensions
16. Identify standard listings on working drawings
17. Size dimensions of holes and angles
18. Locate dimensions for centering of holes, points, and centers
19. Identify half, full, and removed sections
20. Identify usages for chamfers and interpret sizes
21. Sketch oblique views of various parts
22. Sketch and dimension shop drawings

### **Connections:**

\*Common Core Standards

\*KOSSA

\*Common Core Technical Standards

\*New Generation Science Standards

\*NCCER Industry certifications

\*Post-Secondary Education

\*CTSO's-Skills USA

## **Radial Line Development 480814**

### **Course Description:**

Radial Line Development uses many of the procedures of parallel line development and triangulation. The student will learn to develop patterns from any centered, round or square taper, using the radial line method.

Prerequisites: MTF 200

### **Content /Process**

#### **Students Will:**

1. Apply safety rules and procedures
2. Use and care for tools and equipment
3. Interpret building trades blueprint
4. Measure sheet metal to determine the available space for assembly pattern
5. Use the radial line method to lay out sheet metal patterns
6. Select sheet metal gauges for patterns
7. Cut sheet metal with aviation snips
8. Cut sheet metal with straight snips
9. Fabricate residential and commercial heating and air conditioning duct work

### **Connections:**

\*Common Core Standards

\*KOSSA

\*Common Core Technical Standards

\*New Generation Science Standards

\*NCCER Industry certifications

\*Post-Secondary Education

\*CTSO's-Skills USA

**Sheet Metal I - A**  
**480817**

**Course Description:**

This course introduces the student to figuring drawings of plans for a duct system and also learning how to fabricate the ducts.

Prerequisites: Parallel Line Layout -480813

**Content /Process**

**Students Will:**

1. Measure sheet metal to determine available space for assembly patterns
2. Use the radial line method to lay out sheet metal patterns
3. Use the triangular method to lay out sheet metal patterns
4. Use the parallel line method to lay out sheet metal patterns
5. Select sheet metal gauges for patterns
6. Select types of sheet metals
7. Cut sheet metal layouts with aviation snips
8. Cut sheet metal layouts with bulldog snips
9. Cut sheet metal layouts with circular snips
10. Cut sheet metal layouts with combination snips
11. Cut sheet metal layouts with double-cut snips
12. Cut sheet metal layouts with straight snips
13. Store tools
14. Cut sheet metal with hand notchers
15. Cut sheet metal with combination notchers
16. Cut sheet metal with squaring shears
17. Cut sheet metal with universal metal cutters
18. Bend sheet metal with hand seamers
19. Form sheet metal assemblies with blow horn stakes and mallets
20. Form sheet metal assemblies with conductor stakes and mallets
21. Form sheet metal assemblies with common squares and mallets
22. Form sheet metal assemblies with creasing stakes and mallets
23. Form sheet metal with the slip-roll to create cylindrical shape
24. Form single and double hems on sheet metal layouts with brake
25. Turn edges of sheet metal elbow assemblies with an elbow edging machine
26. Form sheet metal assemblies with hollow mandrel stakes and mallets
27. Form sheet metal assemblies with mandrel stakes and mallets
28. Form sheet metal assemblies with needle case stakes and mallets
29. Fabricate residential and commercial heating and air conditioning duct work
30. Cut sheet metal layouts with do-all saws
31. Cut sheet metal layouts with hacksaws.

## Connections:

- \*Common Core Standards
- \*KOSSA
- \*Common Core Technical Standards
- \*New Generation Science Standards
- \*NCCER Industry certifications
- \*Post-Secondary Education
- \*CTSO's-Skills USA

**Sheet Metal I - B  
480818**

**Course Description:**

This course provides advanced training in designing and interpreting plans for a duct system and advanced fabrication of duct systems and precision sheet metal concepts.

Prerequisites: Sheet Metal I - A -480817

**Content /Process**

**Students Will:**

1. Measure sheet metal to determine available space for assembly patterns
2. Use the radial line method to lay out sheet metal patterns
3. Use the triangular method to lay out sheet metal patterns
4. Use the parallel line method to lay out sheet metal patterns
5. Select sheet metal gauges for patterns
6. Select types of sheet metals
7. Cut sheet metal layouts with aviation snips
8. Cut sheet metal layouts with bulldog snips
9. Cut sheet metal layouts with circular snips
10. Cut sheet metal layouts with combination snips
11. Cut sheet metal layouts with double-cut snips
12. Cut sheet metal layouts with straight snips
13. Store tools
14. Make advanced sheet metal cuts with hand notchers
15. Make advanced sheet metal cuts with combination notchers
16. Make advanced sheet metal cuts with squaring shears
17. Make advanced sheet metal cuts with universal metal cutters
18. Make advanced sheet metal bends with hand seamers
19. Form sheet metal assemblies with blow horn stakes and mallets
20. Form sheet metal assemblies with conductor stakes and mallets
21. Form sheet metal assemblies with common squares and mallets
22. Form sheet metal assemblies with creasing stakes and mallets
23. Form sheet metal with the slip-roll to create cylindrical shape
24. Form single and double hems on sheet metal layouts with brake
25. Make advanced sheet metal turned edges or elbow assemblies with an elbow edging machine
26. Form advanced sheet metal assemblies with hollow mandrel stakes and mallets
27. Form advanced sheet metal assemblies with mandrel stakes and mallets
28. Form advanced sheet metal assemblies with needle case stakes and mallets
29. Fabricate advanced residential and commercial heating and air conditioning duct work
30. Glue insulation to the exterior and interior surfaces
31. Install heating, ventilation, and air conditioning ducts
32. Cut advanced sheet metal layouts with do-all saws

33. Cut advanced sheet metal layouts with hacksaws
34. Cut advanced sheet metal layouts with hawk-billed snips
35. Identify capacities for the English Wheel
36. Shape sheet metal parts with the English Wheel
37. Smooth sheet metal parts with the English Wheel
38. Shape sheet metal parts with the Shot Bag and Mallet

### **Connections:**

- \*Common Core Standards
- \*KOSSA
- \*Common Core Technical Standards
- \*New Generation Science Standards
- \*NCCER Industry certifications
- \*Post-Secondary Education
- \*CTSO's-Skills USA

## **Sheet Metal II - A 480819**

### **Course Description:**

This course provides a series of lectures to improve skills in pattern development and fabrication of more difficult fittings.

Prerequisite: Sheet Metal I - B -480818

### **Content /Process**

#### **Students Will:**

1. Apply safety rules and procedures
2. Use and care for tools and equipment
3. Interpret building trade blueprints
4. Draw sheet metal assemblies
5. Use the radial line method to lay out sheet metal patterns
6. Use the triangular method to lay out sheet metal patterns
7. Use the parallel line method to lay out sheet metal patterns
8. Select sheet metal gauges for patterns
9. Cut sheet metal with aviation snips
10. Cut sheet metal with straight snips
11. Cut sheet metal with squaring shears
12. Turn edges of sheet metal elbow assemblies with an elbow turning machine
13. Fabricate residential and commercial heating and air conditioning duct work
14. Install heating, ventilation, and air conditioning ducts
15. Install machine guards and assemblies
16. Use signed numbers
17. Apply algebraic symbols and terms
18. Solve simple equations
19. Solve problems in work-related problems and distinguish between direct and indirect relationships
20. Perform and apply surface measurement calculations
21. Use exponents and radical.

### **Connections:**

- \*Common Core Standards
- \*KOSSA
- \*Common Core Technical Standards
- \*New Generation Science Standards
- \*NCCER Industry certifications
- \*Post-Secondary Education
- \*CTSO's-Skills USA

**Sheet Metal II - B**  
**480820**

**Course Description:**

This course provides a series of advanced lectures to improve skills in advanced pattern development and fabrication of complicated fittings.

Prerequisite: Sheet Metal II – A-480819

**Content /Process**

**Students Will:**

1. Apply safety rules and procedures
2. Use and care for tools and equipment
3. Interpret building trade blueprints
4. Draw advanced sheet metal assemblies
5. Use the radial line method to lay out advanced sheet metal patterns
6. Use the triangular method to lay out advanced sheet metal patterns
7. Use the parallel line method to lay out advanced sheet metal patterns
8. Select sheet metal gauges for patterns
9. Cut sheet metal with aviation snips
10. Cut sheet metal with straight snips
11. Cut sheet metal with squaring shears
12. Turn complicated edges of sheet metal elbow assemblies with an elbow turning machine
13. Fabricate complicated residential and commercial heating and air conditioning duct work
14. Install heating, ventilation, and air conditioning ducts
15. Install machine guards and assemblies
16. Cutting sheet metal parts on the Power Shear
17. Use Mechanical and Computerized Shear Gauges
18. Cutting sheet metal products on the band saw
19. Use Die applications on the Power Brake
20. Alignment and Die setting of Power Brake
21. Introduction to Mig Welding
22. Use CNC Controlled Punch Press
23. Program CNC Controlled Punch Press

**Connections:**

\*Common Core Standards

\*KOSSA

\*Common Core Technical Standards

\*New Generation Science Standards

\*NCCER Industry certifications

\*Post-Secondary Education

\*CTSO's-Skills USA

## Sheet Metal Print Reading 480825

**Course Description:**

This course presents basic applied math, lines, multi-view drawings, symbols, various schematics and diagrams, dimensioning techniques, sectional views, auxiliary views, and sketching typical to sheet metal drawings. Safety will be emphasized as an integral part of the course.

Prerequisites: None

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**Content /Process**

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**Students Will:**

1. Introduction and math review (fractions and decimals)
2. Identify line types used in combinations
3. Identify multiple views
4. Arrange multiple views
5. Demonstrate visualizing techniques of multiple views
6. Identify one view drawing
7. Arrange and identify auxiliary views
8. Demonstrate the use of size and location dimensions
9. Identify standard listings on working drawings
10. Size dimensions of holes and angles
11. Locate dimensions for centering of holes, points, and centers
12. Identify half, full, and removed sections
13. Specify duty specific uses of contour notes
14. Determine overall measurements of contoured parts
15. Explain various terms involved in multiple sections
16. Identify usages for chamfers and interpret sizes
17. Sketch oblique views of various parts
18. Sketch and dimension shop drawings
19. Calculate bend setbacks in sheet metals and plate steels
20. Identify parts and materials from various reference books and manuals

**Connections:**

- \*Common Core Standards
- \*KOSSA
- \*Common Core Technical Standards
- \*New Generation Science Standards
- \*NCCER Industry certifications
- \*Post-Secondary Education
- \*CTSO's-Skills USA

**Special Projects I (MTF)**  
**480879**

**Course Description:**

This is a course designed for the student who has demonstrated specific special needs.

Prerequisites: Radial Line Development 480814

**Content /Process**

**Students Will:**

1. Apply work site and lab safety procedures
2. Describe and apply the problem-solving processes independently or in teams to sheet metal fabrication projects.

**Connections:**

\*Common Core Standards  
\*KOSSA  
\*Common Core Technical Standards  
\*New Generation Science Standards  
\*NCCER Industry certifications  
\*Post-Secondary Education  
\*CTSO's-Skills USA